

A NEW SPECIES OF *LINUM* FROM SOUTHERN TEXAS AND ADJACENT MEXICO

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In an earlier publication (Rogers, 1968) one of the yellow-flowered flaxes, *Linum rigidum* Pursh, was described as comprised of four varieties. Of these the typical variety and var. *compactum* are plants of northern Texas and northward. The var. *berlandieri*, with some reason sometimes considered a separate species, is distributed nearly throughout Texas. It is rather readily distinguished from the other varieties by its comparatively thick-walled fruit and coarse sepals. These three varieties, although displaying some variation which may require further study, are reasonably well defined. The fourth variety, var. *filifolium* Shinnery, however, was described as a "variable population . . . more study is necessary to determine the relationship of the western Texas plants to those of southern Texas, as well as some anomalous collections included here from northern Mexico." In order to help clarify these relationships, the author has collected additional material of var. *filifolium* and attempted a number of crosses between plants from different parts of its range. Herbarium material from the New York Botanical Garden, Southern Methodist University and the University of Texas, including the Lundell Herbarium, has also been reexamined and thanks are expressed to the respective curators.

Within this "variable population," in addition to *Linum rigidum* var. *filifolium*, which, as now interpreted, is a plant of western Texas and nearby Coahuila, two taxa, mostly of southern Texas and adjacent Tamaulipas and Nuevo Leon, can be distinguished. These are *L. elongatum* (Small) Winkler, a species proposed many years ago (Small, 1907), and previously regarded as a synonym (Rogers, 1968), and *L. lundellii*, a previously undescribed species. The latter is named for C. L. Lundell, long a student of the Texas flora and co-collector of the type specimen.

The three taxa may be distinguished from one another in the following way:

1. Styles 7–8 mm long; petals mostly ca. 15 mm long.
2. Sepals lanceolate, acute; petals diffusely brick-red at the base; annual . . . *L. rigidum* var. *filifolium*
2. Sepals lance-attenuate; petals with reddish to wine-colored band below the middle; mostly perennial . . . *L. elongatum*.
1. Styles 3–4 mm long; petals ca. 10 mm long . . . *L. lundellii*

In the following descriptions, petal and anther coloration is taken from

a limited number of living plants, supplemented by scattered information from herbarium labels.

LINUM RIGIDUM Pursh var. *FILIFOLIUM* Shinnery in McVaugh, Field & Lab. 17: 136. 1949. Type: *McVaugh* 7798, 4 Apr 1947, near abandoned wax factory on Rio Grande at mouth of Big Canyon, Brewster Co., Tex. (Holotype: SMU; isotype: TEX).

More or less stiffly branched, essentially glabrous annual herb, 15–35 cm tall; leaves alternate, linear, 10–30 mm long, 0.5–2.0 mm wide; stipular glands mostly present (80% of the specimens examined have stipular glands, but see the discussion which follows the species descriptions); sepals lanceolate, sharply acute, 6–9 mm long, grayish; petals narrowly to broadly obovate, 13–17 mm long, yellow to orange or salmon, brick-red near the base, not banded (Fig. 4a); stamens 5–6 mm long; anthers 1.5–2.5 mm long, yellowish; styles 6.5–8.0 mm long; stigmas dark-wine to black; fruit ovate, ca. 3.5–4.0 mm high, 3.0 mm diameter; seeds reddish-brown, ca. 3.0 mm long, 1.25 mm wide; chromosome no. $n = 15$ (chromosome voucher: *Rogers* 13494, 29 Aug 1976, 4 mi SE of Del Rio, Val Verde Co., Tex. WUD). About 70 collections have been examined. The following citations include the Mexican collections and a specimen from each of the counties in Texas.

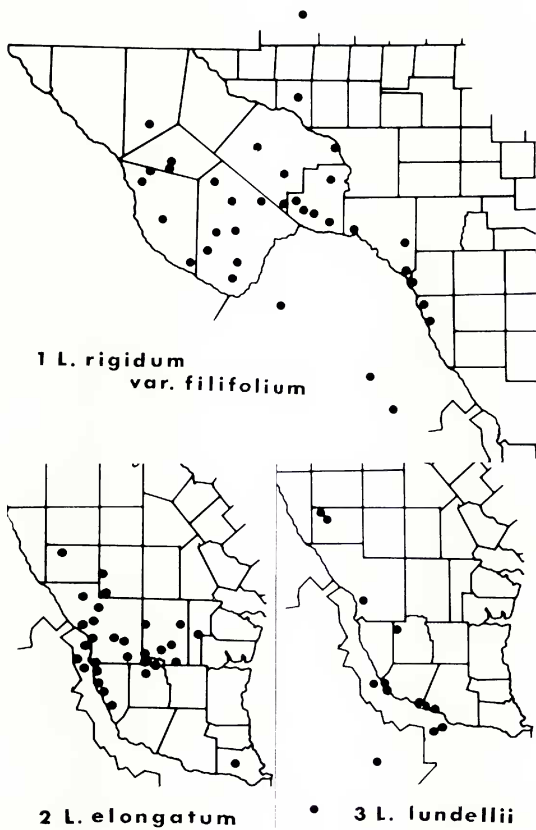
MEXICO. Coahuila: ca. 100 mi NW of Muzquiz, 12 May 1968, *Latorre s.n.* (TEX); Santa Rosa Mts., 14 Jul 1938, *Marsh* 1386 (TEX); S of Sabinas, 29 Mar 1959, *Rinehart* 289 (WUD).

U.S.A. Texas. Andrews Co.: 23 mi on Eunice Highway, 8 May 1960, *Scuddy s.n.* (nearest *L. australe* but apparently with some features of var. *filifolium*) (LL). Brewster Co.: 26 mi E of Marathon, 23 Aug 1947, *Warnock* 6719 (TEX). Crane Co.: ca. 10 mi NW of Crane, 9 May 1966, *Correll* 32773 (appears to combine traits of var. *filifolium* and var. *rigidum*) (LL). Culberson Co.: 51 mi W. Balmorrhea, 29 May 1967, *Mears* 1565a (TEX). Jeff Davis Co.: SW of Mt. Livermore, Davis Mts., 15 Jun 1926, *Demaree & Palmer* 212 (SMU). Kinney Co.: 17 mi SE of Del Rio, 29 Aug 1976, *Rogers* 13493 (WUD). Maverick Co.: 6 mi N of Quemado, 4 Apr 1959, *Correll* 20727 (LL). Pecos Co.: 10 mi S of Ft. Stockton, 10 Apr 1948, *Warnock* 7691 (LL). Presidio Co.: ca. 11 mi W of Valentine, 25 Jun 1948, *York* 48185 (TEX). Terrell Co.: 3 mi W of Dryden, 30 Aug 1976, *Rogers* 13498 (WUD). Val Verde Co.: near Del Rio, 30 Mar 1963, *Correll* 27114 (LL). The distribution is shown in Fig. 1.

LINUM ELONGATUM (Small) Winkler, Nat. Pflanzenfam, ed. 2, 19a: 116. 1931. Type: *Reverchon* 3776, 21 Mar 1903, Laredo (Webb Co.), Tex. (Holotype: NY).

Cathartolinum elongatum Small, North Amer. Flora 25: 82. 1907.

More or less diffusely branched, annual (or merely flowering first year?) or perennial, essentially glabrous herb, 15–30 cm tall; leaves alternate, linear, 5–25 mm long, 0.5–1.0 mm wide; stipular glands present throughout or at bases of upper leaves only; sepals mostly lance-attenuate, 6–11 mm long; petals broadly obovate, 14–18 mm long, yellow-orange to salmon or brown-



Figs. 1-3. Distributions of *L. rigidum* var. *filifolium*, *L. elongatum*, and *L. lundellii*.

ish-red, with a prominent wine-colored band below the middle (Fig. 4b); stamens 5–6 mm long; anthers 1.5–2.5 mm long, brick-red; styles 7.0–9.5 mm long; stigmas mostly grayish to wine-colored; fruit ovate, ca. 4 mm high, 3 mm in diameter; seeds reddish-brown, ca 3 mm long, 1.2–1.3 mm wide; chromosome no. $n = 15$ (chromosome vouchers: *Rogers 13475*, 27 Aug 1976, farm road 2895, 5 mi N of jct. with Tex. 359, Webb Co., Tex.; *Rogers 13482½*, 28 Aug 1976, 1 mi SE of San Ygnacio, Zapata Co., Tex., both WUD). About 65 collections have been examined. The following citations include the Mexican collections and a specimen from each of the counties in Texas.

MEXICO. Tamaulipas: 7 mi S of Nuevo Laredo, 12 Apr 1964, *Fields 45* (TEX); 16 mi S of Nuevo Laredo, 7 Mar 1962, *Garza 35* (TEX); 14 mi S of Nuevo Laredo, 24 Mar 1944, *Heard & Barkley 14604* (TEX); 10 mi SE of Nuevo Laredo, 8 Mar 1964, *Ibarra 103* (TEX); 12 mi S of Nuevo Laredo, 26 Jun 1963, *Rogers 12845* (WUD); 2 mi S of Nuevo Laredo, 26 Jun 1963, *Rogers 12846* (WUD); 7 mi S of Nuevo Laredo, 28 Aug 1976, *Rogers 13476* (WUD); Highway 2, 5 mi E of jct. with Highway 85, S of Nuevo Laredo, 28 Aug 1976, *Rogers 13477* (WUD); 4 mi SW of Nuevo Laredo, 14 Nov 1958, *Rollins & Tryon 5802* (LL); Arroyo Coyote, 7 km Carretera Nacional, 1 Apr 1964, *Vazquez 30* (TEX).

U.S.A. Texas. Cameron Co.: U.S. 83, 12 mi N of Brownsville, 18 Apr 1965, *Rios & Cavazos 262* (LL). Dimmit Co.: 5 mi N of Carrizo Springs, 16 Mar 1963, *Cabrera 80* (TEX). Duval Co.: Realitos, 17 Mar 1934, *Whitehouse 781* (NY). Jim Hogg Co.: 8 mi S of Hebbronville, 20 Mar 1969, *Correll 36801* (LL). Jim Wells Co.: 6 mi S of Alice, 20 Mar 1952, *Jones 699* (SMU). LaSalle Co.: near Encinal, 27 Aug 1976, *Rogers 13470* (WUD). Webb Co.: Laredo, 11 Mar 1944, *Crockett 5417* (LL). Zapata Co.: 13 mi N of San Ygnacio, 31 Jan 1954, *Shinners 17656* (SMU). The distribution is shown in Fig. 2.

LINUM lundellii Rogers, sp. nov. *L. elongato* affine, sed semper annuum, glandulis stipularibus foliorum superiorum nullis, petalis circa 10 mm longis et stylis 3–4 mm longis. Type: *C. L. & A. A. Lundell 9894*, 2 Apr 1941, on gravelly hill, off U.S. 83, W of Sullivan City, Starr Co., Tex. (Holotype: LL).

Annual, essentially glabrous herb, 10–40 cm tall; leaves alternate, linear, 5–30 mm long, 0.5–1.5 mm wide; stipular glands absent above, moderately developed below; sepals linear-lanceolate to lanceolate, acute to acuminate, 4–12 mm long; petals obcordate, 7–12 mm long, yellow to orange-salmon, faintly banded near the base (Fig. 4c); stamens 4–5 mm long; anthers 1.0–1.5 mm long; styles 3.0–4.0 mm long; stigmas mostly dark-wine; fruit ovate, 3.3–4.0 mm high, 2.6–3.1 mm in diameter; seeds reddish brown, 2.5–2.7 mm long, ca. 1.1 mm wide; chromosome no. $n = 15$ (chromosome vouchers: *Rogers 13137*, 2 Jul 1964, 2 mi N of Roma, Starr Co., Tex.; *Rogers 13471*, 27 Aug 1976, 5 mi E of Laredo, Webb Co., Tex., both WUD). In addition to the type and the specimens cited for chromosome number, the following collections have been examined.

MEXICO. Nuevo Leon: ca. 15 mi SW of Galeana, 19 May 1934, *Mueller and Mueller 470* (TEX); 4 mi S of China, 6 Aug 1964, *Rogers 13189* (WUD). Tamaulipas: 5 mi SW of Reynosa, 29 Feb 1944, *Painter & Barkley 14412* (LL); ca.

10 mi SW of Reynosa, 6 Aug 1964, *Rogers 13190* (WUD); 2 mi W of Nuevo Guerrero, 28 Aug 1976, *Rogers 13478* (WUD).

U.S.A. Texas. Dimmit Co.: 2 mi N of Carrizo Springs, 3 Jul 1964, *Rogers 13142* (WUD); 3-4 mi NW of Carrizo Springs, 29 Aug 1976, *Rogers 13486* (WUD); 14 mi NW of Carrizo Springs, 29 Aug 1976, *Rogers 13488* (WUD). Hidalgo Co.: 11 mi W of LaJoya, 28 Aug 1976, *Rogers 13479* (WUD); La Joya, 9 Feb 1942, *Walker 48* (TEX). Jim Hog Co.: Arroyo Baluarte, Thompsonville, 15 Mar 1964, *Correll 29000* (LL). Starr Co.: ca. 1.5 mi N of Roma, 17 Mar 1966, *Correll 32270* (LL); below Falcon Dam, 17 Mar 1962, *Ramos et al 7864* (TEX); near Falcon Dam, 2 July 1964, *Rogers 13138* (WUD); U.S. Highway 83, 3 mi SE of junction with farm road 2098, 28 Aug 1976, *Rogers 13480* (WUD); 3 mi N of Roma, 31 Jan 1954, *Sbimmers 17702* (SMU); Falcon State Park, 14 Mar 1968, *Wood 838* (TEX). The distribution is shown in Fig. 3.

DISCUSSION

Linum lundellii, except for vegetative features such as stature, amount of branching, and leaf size, is a very uniform species and may be readily distinguished from *L. elongatum*, the range of which overlaps that of *L. lundellii*, as well as from *L. rigidum* var. *filifolium* by style length, which is well correlated with other differences such as petal size and shape, anther size, and the absence of stipular glands at the bases of upper leaves. Its distinctiveness is supported by the results of attempted crosses with *L. elongatum* (128 crosses) and with *L. rigidum* var. *filifolium* (164 crosses), none of which produced functional seeds.

In *L. lundellii* the anthers are placed at about the same level as the stigmas (Fig. 4c). In garden-grown plants, by the time the flowers were well opened, pollen had already been deposited upon the stigmas. In these plants self-pollination was certainly the rule. In *L. elongatum* and *L. rigidum* var. *filifolium* the styles extend well beyond the anthers (Fig. 4a,b), and there are ordinarily a few hours (depending upon cloudiness and wind conditions) during which the anthers have dehisced, but pollen has not been shed. In the Michigan garden no insect pollinators were observed; these may be present in the natural range of the species. There is at least the opportunity for outcrossing. If cross-pollination fails, however, self-pollination is assured, since the intact corolla, before falling, ordinarily slips upward past the open anthers like an ascending collar, depositing pollen on the stigmas above.

Linum elongatum and *L. rigidum* var. *filifolium* appear to be closely related. It may be that some hybridization takes place between the two in the field. The results of experimental crosses between the two reflect this possibility; one or more rather weakly developed but mature seeds were produced in 14 of 136 crosses attempted. Of a series of features that differentiate the two, possibly none holds for every comparison of individual specimens. For example, most collections of *L. elongatum* are perennial. This is a very unusual character in the "*L. rigidum* complex" of about twelve species. *Linum subteres* (Trel.) Winkler, of Utah and Nevada, is the only other which is

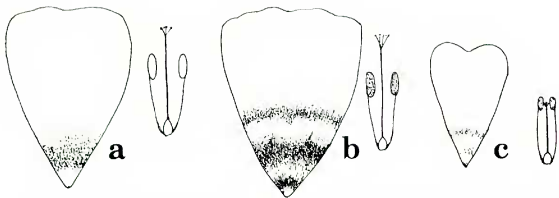


Fig. 4. Petal, stamens and pistil of *L. rigidum* var. *filifolium* (a), *L. elongatum* (b), and *L. lundellii* (c). All x 2.5.

consistently perennial. However, *L. elongatum* flowers the first year, and a number of herbarium specimens appear to be or are annual. In addition, two collections of *L. rigidum* var. *filifolium* are quite clearly perennial.

The petal coloration of *L. elongatum* makes this one of the most attractive of the flax species. The author's collections and the several dozen plants grown from their seed were uniformly colored in the manner described. Dried specimens, because of the fading of the pigments and because petals have frequently fallen if collections are made late in the day, do not always show petal color. In garden-grown plants, one individual (of about 40 plants), which otherwise had the characters of (and was identified as) *L. rigidum* var. *filifolium*, had the petal coloration of *L. elongatum*. Otherwise the two taxa were easily distinguished on this character alone. The attenuate sepals, which were the basis for the selection of the specific epithet for *L. elongatum*, can be used for the identification of most specimens, but there is enough variation in both taxa that some specimens would be difficult to place using that character alone.

Linum elongatum uniformly possesses stipular glands at the bases of the upper leaves; *L. lundellii* uniformly lacks them there, although they may be moderately developed at the bases of the lower leaves. Most collections of *L. rigidum* var. *filifolium* have stipular glands also, but with the exception of a single collection from near Del Rio, none of the specimens from Val Verde, Kinney, or Maverick Counties have stipular glands. This may provide another distinguishing feature between *L. rigidum* var. *filifolium* and *L. elongatum*, if one is needed, in the region of closest geographical proximity of the two taxa. Based upon the specimens thus far examined, the range of *L. rigidum* var. *filifolium* is distinct from those of either *L. elongatum* or *L. lundellii*, being restricted in Texas to northwestern Maverick Co. and northwestward, while *L. elongatum* and *L. lundellii* are found only from Dimmit County southeastward.

REFERENCES

- ROGERS, C. M., 1968. Yellow-flowered species of *Linum* in Central America and western North America. *Brittonia* 20: 107-135.
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